100

CPU
101

Cache SRAM
106

CPU Bus **102**

System Controller **103**

DRAM Controller **104**

Control

Address

Data & Parity

RAM **105**

Peripheral Bus **110**

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Bridge Controller **111**

Disk Controller

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Network Adapter **114**

Video Controller **112**

Video Display **115**

ISA Bus **120**

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Keyboard Controller. RTC, Serial, Parallel Ports **121**

ROM **122**

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Audio **124**

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Fig. 1

Traditional Class A System (no parallel commands)

User	Commands
1) Select "Extrapolation" command.	➢ Activate "Extrapolation" command.
2) Select patch 1.	➢ Mark patch 1 for extrapolation command.
3) Extrapolate patch 1 (dynamic interactive) by moving the extrapolation handle to the left, until the result satisfies.	For each dynamic step on modification of patch 1 do: ➢ Extrapolate
4) Select Matching command.	➢ Activate Matching command.
5) Select patch 2 as modified patch with neighbor edge to patch 1.	➢ Mark patch 2 for Matching as modification patch.
6) Select patch 1 as reference patch with neighbor edge to patch 2.	➢ Mark patch 1 for Matching as reference patch.
7) Adjust matching parameter (deactivate partly, inverse direction)	
8) Activate Matching.	➢ Match
9) Select Control Point command	➢ Activate "Control Point" command.
10) Select patch 2.	➢ Mark patch 2 for "Control Point" command.
11) Move third control point row of patch 2 (dynamic interactive) using one of the line segments of the control point mesh handle, until the following matching will satisfy (this is a guess).	For each dynamic step on modification of patch 2 do: ➢ Adjust control points.
12) Select Matching again.	➢ Activate Matching command.
13) Select patch 2 as modified patch with neighbor edge to patch 1.	➢ Mark patch 2 for Matching as modification patch.
14) Select patch 1 as reference patch with neighbor edge to patch 2.	➢ Mark patch 1 for Matching as reference patch.
15) Activate Matching.	➢ Match
Repeat step 9 and 15 until result satisfies.	

Fig. 2

Class A System with parallel commands

User	Main Command, Slot
1) Select "Control Point" command.	➢ Include "Control Point" command into the active command table. ➢ Activate "Control Point" command.
2) Select patch 1.	➢ Include patch 1 into geometry table (slot) and mark it for active command "Control Point". ➢ Send "Update 3D Handles" notification to "Control Point" command.
3) Select patch 2.	➢ Include patch 2 into geometry table (slot) and mark it for active command "Control Point". ➢ Send "Update 3D Handles" notification to "Control Point" command.
4) Select Matching command.	➢ Include Matching command into the active command table. ➢ Activate Matching command.
5) Select patch 2 as modified patch with neighbor edge to patch 1.	➢ Mark patch 2 in geometry table for active command Matching as modification patch. ➢ Send "Update 3D Handles" notification to Matching command.
6) Select patch 1 as reference patch with neighbor edge to patch 2.	➢ Mark patch 1 in geometry table for active command Matching as reference patch. ➢ Send "Update 3D Handles" notification to Matching command.
7) Select Extrapolation command.	➢ Include Extrapolation command into the active command table. ➢ Activate Extrapolation command.
8) Select patch1.	➢ Mark patch 1 in geometry table for active command Extrapolation. ➢ Send "Update 3D Handles" notification to Extrapolation command.
9) Extrapolate patch 1 (dynamic interactive) by moving the extrapolation handle to the left, until the result satisfies.	For each dynamic step on modification of patch 1 do: ➢ Check all commands marked on patch 1: • Found Matching. ▪ Send "Update 3D Handles" notification to Matching. • Found "Control Point Modification". ▪ Send "Update 3D Handles" notification to "Control Point Modification". • Found Extrapolation. ▪ Send "Update 3D Handles" notification to Extrapolation. ➢ Finish dynamic step.
10) Activate Matching by clicking on the matching handle	➢ Check all commands marked on patch 2: • Found Matching. ▪ Send "Update 3D Handles" notification to Matching. • Found Control Point Modification. ▪ Send "Update 3D Handles" notification to "Control Point".
11) Move third control point row of patch 2 (dynamic interactive) using one of the line segments of the control point mesh handle, until the following matching will satisfy (this is a guess).	For each dynamic step on modification of patch 2 do: ➢ Check all commands marked on patch 2: • Found Matching. ▪ Send "Update 3D Handles" notification to Matching. • Found Control Point Modification. ▪ Send "Update 3D Handles" notification to "Control Point". ➢ Finish dynamic step (patch 2 already handled).
12) Activate Matching again by clicking on the matching handle	➢ Check all commands marked on patch 2: • Found Matching. ▪ Send "Update 3D Handles" notification to Matching. • Found Control Point Modification. ▪ Send "Update 3D Handles" notification to "Control Point".
Repeat step 11 and 12 until result satisfies.	

Fig. 3

Class A system with parallel and associative commands

User	Main Command, Slot
1) Select "Control Point" command.	➢ Include "Control Point" command into the active command table. ➢ Activate "Control Point" command.
2) Select patch 1.	➢ Include patch 1 into geometry table (slot) and mark it for active command "Control Point". ➢ Send "Update 3D Handles" notification to "Control Point" command.
3) Select patch 2.	➢ Include patch 2 into geometry table (slot) and mark it for active command "Control Point". ➢ Send "Update 3D Handles" notification to "Control Point" command.
4) Select Matching command.	➢ Include Matching command into the active command table and mark it as associative command. ➢ Activate Matching command.
5) Select patch 2 as modified patch with neighbor edge to patch 1.	➢ Mark patch 2 in geometry table for active command Matching as modification patch. ➢ Send "Update 3D Handles" notification to Matching command.
6) Select patch 1 as reference patch with neighbor edge to patch 2.	➢ Mark patch 1 in geometry table for active command Matching as reference patch. ➢ Send "Update 3D Handles" notification to Matching command.
7) Select Extrapolation command.	➢ Include Extrapolation command into the active command table. ➢ Activate Extrapolation command.
8) Select patch1.	➢ Mark patch 1 in geometry table for active command Extrapolation. ➢ Send "Update 3D Handles" notification to Extrapolation command.

9) Extrapolate patch 1 (dynamic interactive) by moving the extrapolation handle to the left, until the result satisfies.	For each dynamic step on modification of patch 1 do:
	➢ Check all commands marked on patch 1:
	  • Found Matching (associative).
	    ▪ Activate Matching Action.
	    ▪ Mark Patch 2 as modified (by Matching).
	    ▪ Send "Update 3D Handles" notification to Matching.
	  • Found "Control Point Modification".
	    ▪ Send "Update 3D Handles" notification to "Control Point Modification".
	  • Found Extrapolation.
	    ▪ Send "Update 3D Handles" notification to Extrapolation.
	➢ Look for patches modified by associative commands:
	➢ Found patch 2.
	➢ Check all commands marked on patch 2:
	  • Found Matching (associative).
	    ▪ No Action, because matching itself modified patch 2.
	    ▪ Send "Update 3D Handles" notification to Matching.
	  • Found Control Point Modification.
	    ▪ Send "Update 3D Handles" notification to "Control Point Modification".
	➢ Finish dynamic step.

10) Move third control point row of patch 2 (dynamic interactive) using one of the line segments of the control point mesh handle, until the result satisfies.	For each dynamic step on modification of patch 2 do:
	➢ Check all commands marked on patch 2:
	  • Found Matching (associative).
	    ▪ Activate Matching Action.
	    ▪ Send "Update 3D Handles" notification to Matching.
	  • Found Control Point Modification.
	    ▪ Send "Update 3D Handles" notification to "Control Point".
	➢ Look for patches modified by associative commands:
	➢ Found patch 2.
	➢ Finish dynamic step (patch 2 already handled).

Fig. 4

Class A system with parallel commands, associative commands and scene storage

User	Main Command, Slot
1) Select stored scene.	➢ Reactivate all scene commands (Control Point, Matching, Extrapolation) with associated geometry selections and tool representations from the stored scene.

2) Extrapolate patch 1 (dynamic interactive) by moving the extrapolation handle to the left, until the result satisfies.	For each dynamic step on modification of patch 1 do:
	➢ Check all commands marked on patch 1:
	  • Found Matching (associative).
	    ▪ Activate Matching Action.
	    ▪ Mark Patch 2 as modified (by Matching).
	    ▪ Send "Update 3D Handles" notification to Matching.
	  • Found "Control Point Modification".
	    ▪ Send "Update 3D Handles" notification to "Control Point Modification".
	  • Found Extrapolation.
	    ▪ Send "Update 3D Handles" notification to Extrapolation.
	➢ Look for patches modified by associative commands:
	➢ Found patch 2.
	➢ Check all commands marked on patch 2:
	  • Found Matching (associative).
	    ▪ No Action, because matching itself modified patch 2.
	    ▪ Send "Update 3D Handles" notification to Matching.
	  • Found Control Point Modification.
	    ▪ Send "Update 3D Handles" notification to "Control Point Modification".
	➢ Finish dynamic step.

3) Move third control point row of patch 2 (dynamic interactive) using one of the line segments of the control point mesh handle, until the result satisfies.	For each dynamic step on modification of patch 2 do:
	➢ Check all commands marked on patch 2:
	  • Found Matching (associative).
	    ▪ Activate Matching Action.
	    ▪ Send "Update 3D Handles" notification to Matching.
	  • Found Control Point Modification.
	    ▪ Send "Update 3D Handles" notification to "Control Point".
	➢ Look for patches modified by associative commands:
	➢ Found patch 2.
	➢ Finish dynamic step (patch 2 already handled).

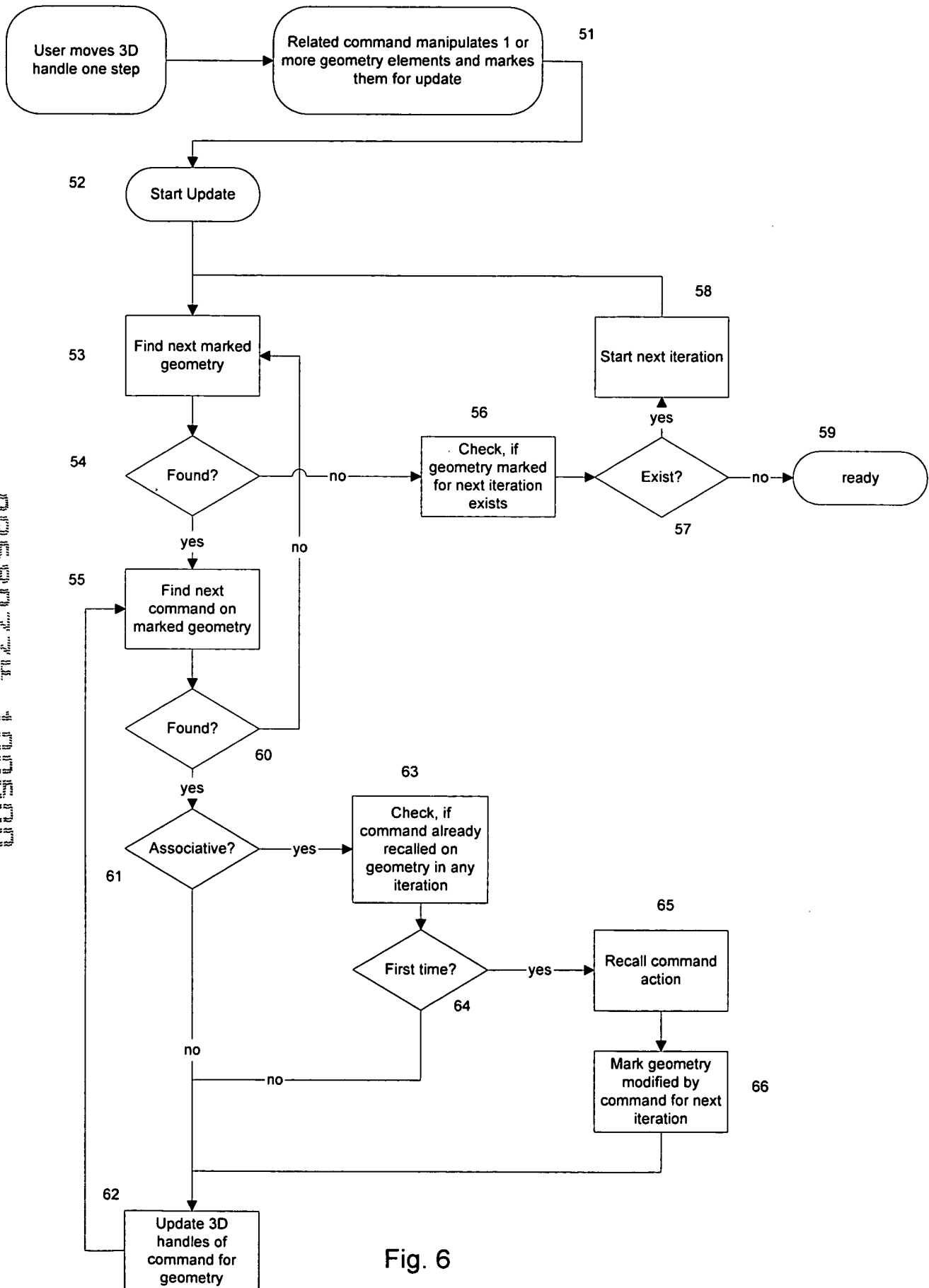## Fig. 5

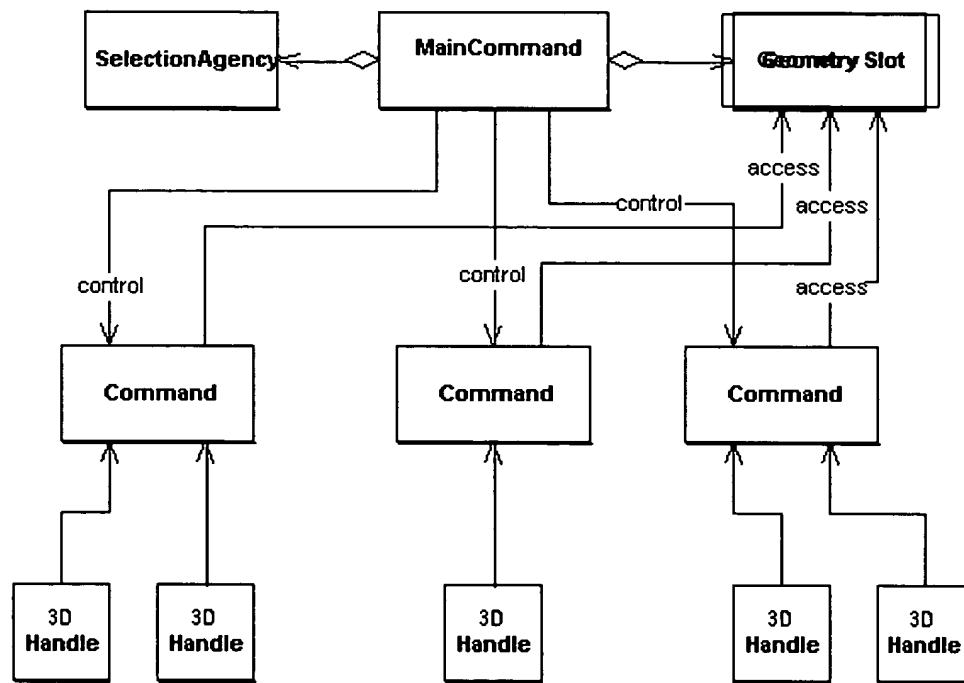# Update Process for Parallel and Associative Commands

50

User moves 3D handle one step

→

51
Related command manipulates 1 or more geometry elements and markes them for update

52 Start Update

53 Find next marked geometry

54 Found? —no→ **56** Check, if geometry marked for next iteration exists →

57 Exist? —no→ **59** ready

58 Start next iteration ↑ yes

Found? yes ↓

55 Find next command on marked geometry

Found? —no (60)

yes ↓

61 Associative? —yes→ **63** Check, if command already recalled on geometry in any iteration

↓ First time? (64) —yes→ **65** Recall command action

↓

66 Mark geometry modified by command for next iteration

no —no—

62 Update 3D handles of command for geometry

Fig. 6

Global View

Fig. 7